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Expert System for Diagnosis of Heart Disease: A Review

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***Abstract*—** In order to diagnose any disease, the expert system developed by human may be a cheering way out to diminish cost, time, human efforts and medical error. This paper focuses on today's most severe heart related diseases. It also discusses different expert systems that are presently used in the field of medical sciences. Further, noteworthy contribution is also cited. Additionally, it reveals the well-known database used for heart disease diagnosis i.e. UCI repository.

***Keywords*—** Diagnosis, Expert System, FIS, Fuzzy, Heart Attack

I. INTRODUCTION

Nowadays to live luxurious life people work like machine in order to earn lot of money hence they forget to take care of their health. Because of this, there is change in the food which they consume, their lifestyle changes and finally, leads to diabetes, blood pressure and various other diseases at young age. All these reasons lead to negligence of their health which increases the chances of heart disease. Heart is the most essential organ of the human body and if it gets affected then it also affects the other major organs of the body. So, Doctors will use this system to keep track of the patient consulting to them. The Heart Disease Prediction System (HDPS) can discover and extract hidden knowledge associated with diseases from a heart disease database.

The rest of the paper is organized as follows. Section II reveals various expert systems in the field of medicine. Noteworthy contribution in this field is discussed in section III. Section IV presents the database used for its diagnosis and finally, section V concludes the paper.

II. EXPERT SYSTEMS IN THE FIELD OF MEDICINE

An expert system is a computer program that incorporates knowledge to solve complex problems and can either replace or assist a human expert [1, 2]. Many expert systems have been developed to diagnose diabetes and heart diseases, where diagnosis is complex and involves up-to-date parameters. Conigliaro et al. in [3] proposed an expert system for venous insufficiency in the human body using statistical evaluation to detect a set of particular symptoms among others.

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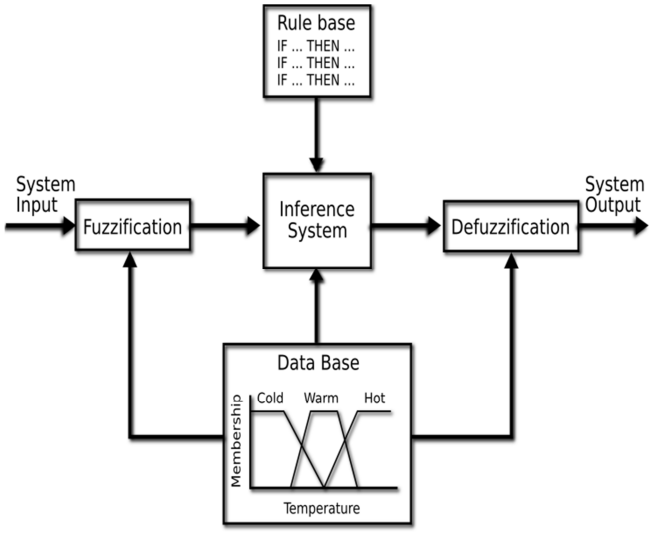

Figure 1 : Fuzzy Inference System

In the area of medical sciences, numerous expert systems have been developed. These are:

- PUFF: Pulmonary disease diagnosis
- GUIDON: Microbial disease education
- VM: Monitoring of patients need to intensive care
- ATTENDING: Anesthesia management education
- ABEL: Diagnosis of acidic materials and electrolytes
- ONCOCIN: Treatment and management of patient's chemotherapy
- AI/COAG: Blood disease diagnosis
- MYCIN: Microbial disease diagnosis and treatment
- AI/RHEUM: Rheumatic disease diagnosis
- CADUCEUS: Internal medicine disease diagnosis
- BLUEBOX: Depression diagnosis and treatment
- ANNA: Monitoring and treatment analysis

III. LITERATURE SURVEY

There are several authors who diagnosed the heart diseases and achieved dissimilar probabilities for different methods of data mining techniques. The current novel variety of work is connected and initiated to diagnose heart diseases by data mining techniques. Heon Gyu Lee et al. [4] proposed the latest utilization techniques of Statistical and classification for the extension of the multi-parametric feature with linear and nonlinear characteristics of Heart Rate Variability (HRV), which have also been assessed for the three recumbent positions, to be accurate the supine, the left and right side locations of the HRV. There are several classifiers such as Support Vector Machine (SVM) [5], Classification based on Multiple Association Rules (CMAR) [6], Bayesian classifiers [7], Decision Tree (C4.5) [8] and which has been surmounted the other classifiers too, have been experimented for the assessment of the linear and nonlinear characteristics of the HRV indices.

Sellappan Palaniappan et al. [9] developed Intelligent Heart Disease Prediction System (IHDPS). Each method possesses its own power to gain suitable results. The hidden patterns and relationships among them have been used to construct this system. The IHDPS is user-friendly, web-based, scalable, reliable and expandable Niti Guru et al. [10] proposed the prediction of Sugar, Blood Pressure and Heart disease by using neural networks. The supervised network has been suggested for diagnosis of heart disease. Training was passed out with the aid of back-propagation algorithm. The mysterious data was fed at any time by the doctor, the identified method that the unknown data from the comparisons with the trained data and generated a list of probable diseases that the patient is prone to heart disease.

Carlos Ordonez [11] describes the inhibited problem to identify and to predict the rules of association for the heart disease. It includes medical records of the heart disease patients with attributes for the risk factors, measurements of heart perfusion and narrowed artery. The three constraints were introduced to reduce the number of patterns, they are as follows:

a) The attributes have to appear on one side of the rule only.
b) The rule separates the attributes into the uninteresting groups.
c) The number of attributes from the rule is controlled by the medical records of the people of heart disease finally.

Further falling the running time as per the experiments illustrated the constraints of showing rules have been extremely decreased the number. The author, Carlos Ordonez, anticipated the presence or the absence of heart disease in four specific heart arteries into the two groups of rules. According to the work of Franck Le Duff et al. [12], it is executed for each medical procedure or medical problem.

Boleslaw Szymanski et al. [13] projected a novel heuristic for the ability of computation of sparse kernel in SUPANOVA. It was applied to a standard Boston housing market dataset and to the discovery of the heart diseases in the population generally major topic of striking with the aid of a novel, non-invasive measurement of the heart activities on the basis of attractive field generated by the human heart. 83.7% predictions on the results were correct, in this manner outperforming the results which were obtained through Support Vector Machine and equivalent kernels. The spline kernel yielded good results equally on the standard Boston housing market dataset.

Kiyong Noh et al. [14] has been placed forth a classification method for the extraction of multi parametric features by assessing HRV from ECG, the data pre-processing and the heart disease pattern. The proficient FP-growth method was the foundation of this method which is an associative. They accessible a rule cohesion measure that allows a strong press on pruning patterns in the pattern of generating method as the volume of patterns created could probably be huge. Kasbe [15] has also given most of the information about dengue fever, one of the most dangerous diseases of the world. They have also mentioned first vaccine of dengue.

In this context, computer has been used in our fields too like automated drip irrigation [16], fuzzy logic controller in cloud computing [17], expert system to predict the dengue fever [18] and many more.

IV. DATABASE USED FOR DIAGNOSIS OF HEART ATTACK

Generally, Pima Indian Diabetes (PID) [19] is used in the diagnosis of heart disease. PID consists of 270 cases. It has only two decision classes, one is absence (0) instance and the other is presence (1). Each subject has thirteen attributes, including: age, sex, chest pain type, resting blood pressure, serum cholesterol, resting electrocardiographic results, fasting blood sugar, maximum heart rate achieved, exercise induced angina, old peak = ST depression induced by apply virtual to relax, the slope of the peak exercise ST segment, number of major vessels and Thal.

Table 1: Attributes with their description and values

No.	Attributes	Values
1	Age (in years)	Continuous
2	Sex (male or female)	Value 1 :Male , 0: Female
3	Chest pain type	1: typical type 1 angina, 2: typical type angina, 3: non angina pain, 4 : asymptotic
4	Resting blood pressure	0_120,121_150,150_max mm hg

5	Serum cholesterol	0_200,200_239,240_max
6	fasting blood sugar	1: >120 mg/dl ; 2:
7	Resting electrocardiographic results	0 : normal, 1:having St-T abnormality; 2: showing probable left ventricular hypertrophy
8	Maximum heart rate achieved	0_120,121_150,150_max
9	Exercise induced angina	Value 1: yes ; 0:no
10	Old peak (ST despair induced by apply virtual to relax)	0_1.5,1.5_4.5,4.5_max
11	Slope of the peak exercise	Value 1: un-sloping ; 2: flat; 3: down-slopping
12	Number of major vessels painted by fluoroscopy	Number of major vessels colored by fluoroscopy (value 0-3)
13	Thal	3: normal ; 6: fixed defect; 7: reversible defect

V. CONCLUSION

Clinical Decision Support System for heart diseases is very effective tool for diagnosing the diseases. It gathers the patient health information (PHI) and by using pre-determined algorithms or rules, it gives decisions. System will give decision of probability for patient been prone to heart diseases. But still many cases are reported of erroneous diagnosis and wrong treatment. Patients advised to undergo a lot of tests for treatment.

This paper focuses on today's most severe heart related diseases. It also discusses different expert systems that are presently used in the field of medical sciences. In addition to this, a brief survey of related papers is also discussed. Moreover, it describes the well known database used for heart disease diagnosis.

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